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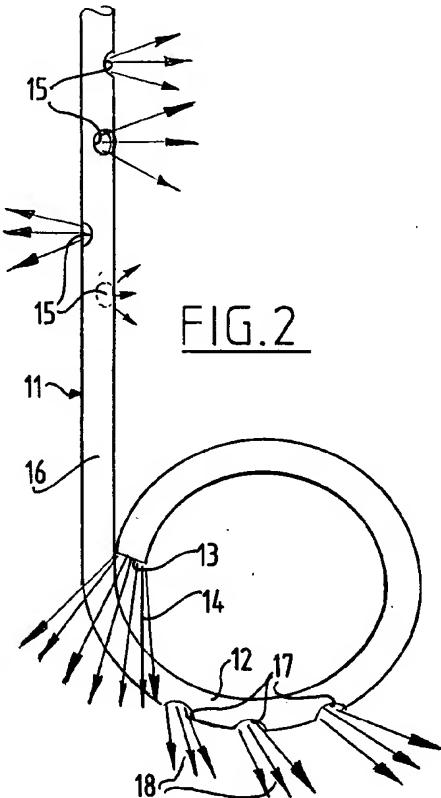
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(54) **Angiography catheter.**

(57) The invention relates to an angiography catheter comprising a hose-like body (16) with at least one lumen debouching at the distal end in an end opening (13), wherein the distal end has a permanent curvature (12) and a number of openings (17) is arranged in the wall. At least some of the openings are herein arranged in the curvature in a side of the wall remote from the end opening, such that reaction forces in the distal end when injecting fluid through the lumen, are substantially balanced. The angiography catheter can be of the so-called "pigtail" type, with a circular curvature through substantially 360°, wherein openings are arranged in the first 180° of the curvature in the outward facing portion of the wall.



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The invention relates to an angiography catheter comprising a hose-like body with at least one lumen debouching in an end opening at the distal end. The distal end has a permanent curvature and a number of openings is arranged in the wall of the catheter.

Such a catheter is for example a diagnostic cardiac catheter which is guided via a blood vessel into the heart. A contrast liquid can be introduced via the lumen so that the contours of for example a ventricle of the heart of a patient can be made visible on an X-ray screen in a catheter laboratory. In accordance with the area of the blood vessel system of the patient to be examined, a catheter is used with a specific curvature, which curvature is designed such that the distal end of the catheter will assume a stable position in the intended area.

With known angiography catheters of this type the curvature can deform quite considerably during injection of the contrast liquid as a result of the reaction forces of the contrast liquid flowing in the curvature and spouting outward from the end opening. This can endanger the stable position of the end portion of the catheter.

The invention now has for its object to improve a catheter of the type described in the preamble such that it also has a stable position during injection of the contrast liquid.

This objective is achieved with an angiography catheter as characterized in claim 1. Due to the openings arranged in the curvature in a side of the wall remote from the end opening, a quantity of liquid is discharged and the reaction forces resulting from the remaining liquid become accordingly smaller. The pressure in the curvature is thereby also lower whereby the "uncurling" as a result of a Bourdon spring effect is likewise reduced. Moreover, a reaction force is herein generated which attempts to bend the catheter in a direction opposite to that in which the catheter is bent by the reaction force of the liquid coming out of the end opening. These effects largely cancel each other out, so that during injection of the contrast liquid, even if this takes place at high pressure, a very limited deformation at most of the permanent curvature of the catheter occurs. The angiographic examination can hereby take place more rapidly and accurately.

The invention can be applied particularly well with an angiography catheter of the so-called "pigtail" type. The curvature herein is a circular curvature through practically 360°. In the known "pigtail" catheter the curvature is bent outward by the reaction force of the liquid spouting out from the end opening, whereby the desired shape of the curvature is disturbed and the direction in which the contrast liquid spouts out is moreover considerably altered. With the catheter according to the

invention of this type, openings are arranged in the first 180° of the curvature in the outward facing portion of the wall. These openings drain off a portion of the liquid, whereby the forces in and on the curvature become smaller because the quantity of liquid and the pressure thereof in the curvature decrease. The liquid flowing outward through the openings causes a reaction force which results in strengthening of the curvature of the catheter and thus counteracts the "uncurling".

The placing of the openings in the manner according to the invention moreover has the advantage that contrast liquid is better directed towards the apex of the heart ventricle under examination, so that the whole action of the catheter is improved.

The openings arranged in the curvature are preferably additional to the usual openings in the portion of the basic body lying in advance of the curvature. The number of openings in the catheter according to the invention is thus larger than in a catheter according to the prior art, so that a more uniform egress of contrast liquid over a larger area is achieved. This moreover achieves that the total quantity of liquid coming out of the end opening is smaller and the pressure of the jet coming out of the end opening on the wall of the heart ventricle toward which this jet is directed during the examination, can decrease greatly. Heart arrhythmia occurring with catheters of this type according to the prior art are hereby avoided.

The invention will be further elucidated in the following description with reference to the embodiments shown in the figures.

Fig. 1 shows an angiography catheter of the "pigtail" type according to the prior art.

Fig. 2 shows a view corresponding with fig. 1 of an angiography catheter of the "pigtail" type according to the invention.

Fig. 3 shows the catheter of fig. 2 during use.

For elucidation of the principle of the invention fig. 1 and 2 show next to each other an angiography catheter of the "pigtail" type according to the prior art (fig. 1) and according to the invention (fig. 2).

The catheter 1 according to the prior art shown in fig. 1 has in the usual manner a basic body 6 with a lumen. In fig. 1 only the distal end is drawn which, as shown here, has a circular curvature 2 through slightly less than 360°. The end of the lumen debouches into an end opening 3. Arranged in the portion of the basic body 6 lying in advance of the curvature 2 is a number of openings 5 which connect the lumen to the environment.

During use a contrast liquid is injected into the proximal end of the catheter, which liquid comes out at the distal end shown in fig. 1 through the end opening 3 and the openings 5. The jet 4

coming out of the end opening 3 causes a reaction force on the curvature 2 which results in the "unrolling" of curvature 2. This situation is indicated with dashed lines. During the examination the catheter thus moves as a result of this unrolling effect so that the position thereof is not stable.

The catheter 11 according to the invention shown in fig. 2 likewise comprises a basic body 16 with a curvature 12 on the end thereof which is substantially a circular curvature through 360°. Here the lumen also forms an end opening 13 out of which comes a jet 14 of contrast liquid during use.

As shown in fig. 2, in the first 180° of the curvature, taken from the basic body, openings 17 are arranged in the side of the wall facing away from the end opening 13, that is, in the outward facing portion of the wall. During use of the catheter, jets 18 of contrast liquid egress through these openings 17. These jets 18 cause a reaction force which attempts to enhance the curvature 12 and thus acts counter to the reaction force caused by the jet 14. The effect is that the curvature 14 deforms to a limited degree at most, whereby a considerably more stable position of the curvature is obtained.

The catheter shown in fig. 2 is a preferred embodiment wherein the openings 17 are additional to the openings 15 arranged in the conventional manner in the portion of the basic body 16 lying in advance of the curvature. These openings 15 correspond to the openings 5 in the catheter 1 according to the prior art.

In this preferred embodiment the number of openings in the distal end of the catheter is thus increased, so that the jet 14 finally coming out of the end opening 13 is considerably less powerful than according to the prior art. This also reduces the "unrolling" effect of the jet 14.

As fig. 3 shows, the jet 14 is usually oriented to the wall of the heart ventricle 21 during the examination of the heart 20 of a patient. Since in the preferred embodiment of the invention the strength of jet 14 is reduced, the irritation of the wall of the heart ventricle 21 is limited, so that the heart rhythm is not disturbed or much less so.

Fig. 3 also shows that the catheter of the "pigtail" type described here is carried via the aorta 22 into the ventricle 21. Due to the specific shape of the curvature, the end portion of the catheter remains lying stably in the ventricle 21 in the manner shown. During injection of the contrast liquid the catheter according to the invention also retains its position.

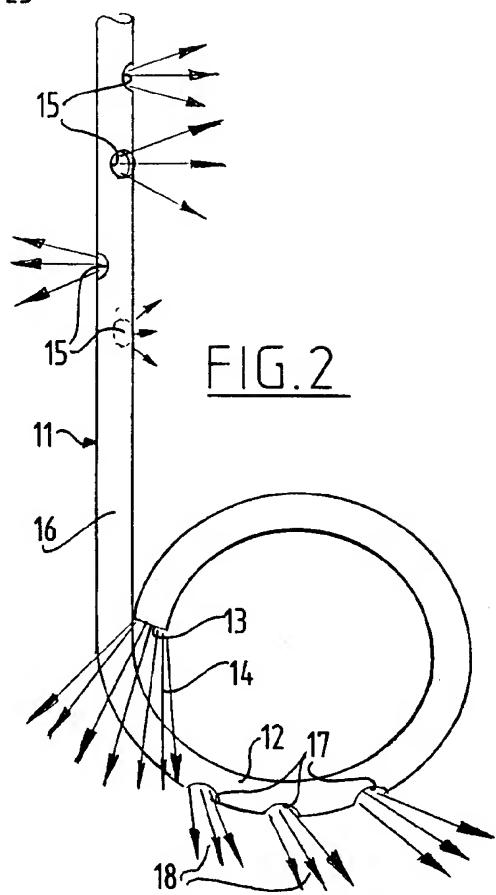
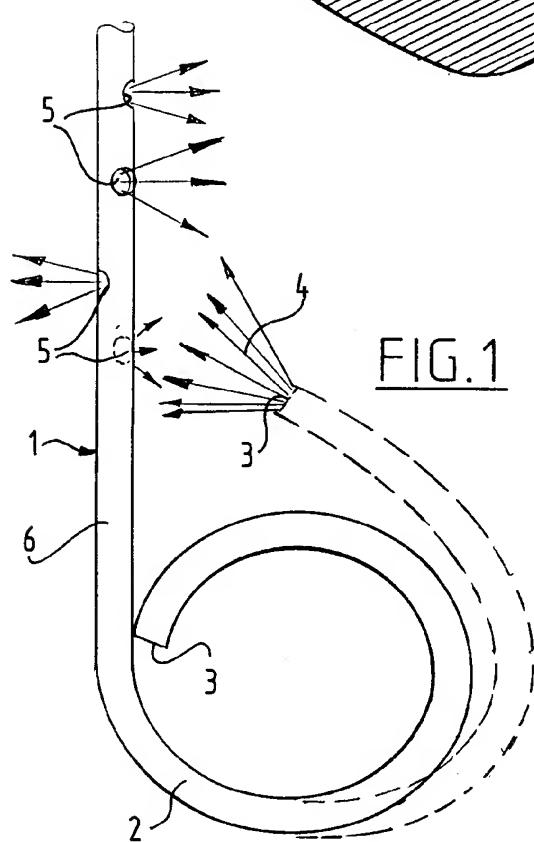
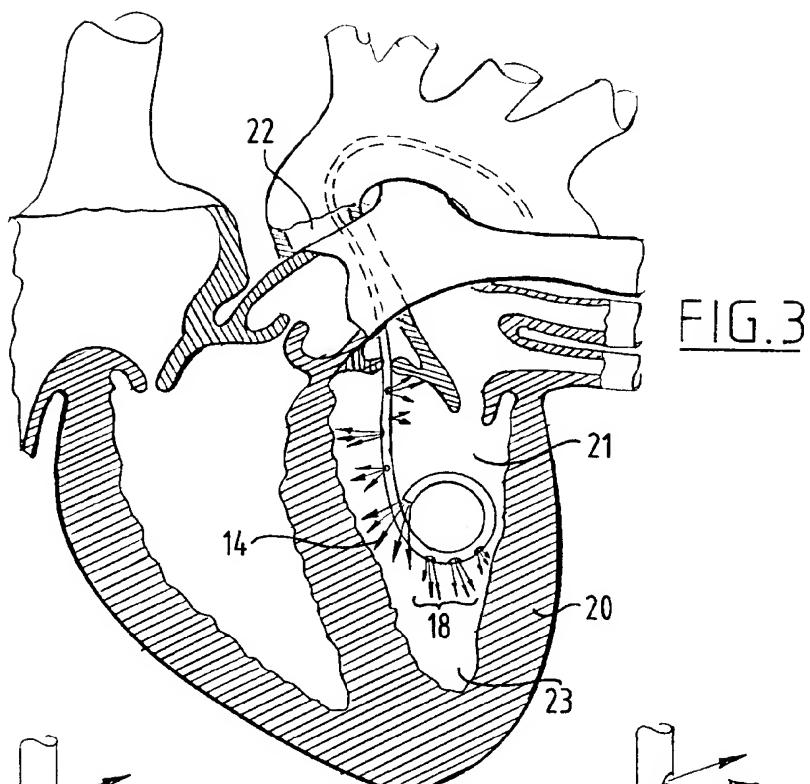
An additional advantage of the openings 17 arranged in the curvature is that the jets 18 of contrast liquid coming out therethrough penetrate well into the apex 23 of the heart ventricle 21 so

that on an X-ray screen a clear image of the contours of the ventricle 21 can be obtained.

Although the invention can be applied particularly favourably in the case of the described angiography catheter of the "pigtail" type, the invention is not limited to use with this type of catheter. In all angiography catheters with a curved end, openings can be arranged according to the invention in the wall of the curvature, in a side of the wall facing away from the end opening, in order to obtain the described effect of counteracting the deformation of the curvature by the jet coming out of the end opening.

Claims

- 5 1. Angiography catheter comprising a hose-like body with at least one lumen debouching at the distal end in an end opening, wherein the distal end has a permanent curvature and a number of openings is arranged in the wall, wherein at least some of the openings are arranged in the curvature in a side of the wall remote from the end opening, such that reaction forces in the distal end when injecting fluid through the lumen, are substantially balanced.
- 10 2. Angiography catheter as claimed in claim 1 of the so-called "pigtail" type, with a circular curvature through substantially 360°, wherein openings are arranged in the first 180° of the curvature in the outward facing portion of the wall.
- 15 3. Angiography catheter as claimed in claim 1 of the so-called "pigtail" type with a circular curvature through substantially 360°, wherein openings are arranged in the first 90° of the curvature in the outward facing portion of the wall.
- 20 4. Angiography catheter as claimed in claim 2 or 3, wherein the openings arranged in the curvature are additional to openings arranged in per se known manner in the part of the basic body lying in advance of the curvature.
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EUROPEAN SEARCH REPORT

Application Number

EP 94 20 0277

DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)		
X	GB-A-2 166 958 (MULCHIN) * abstract; figures * ---	1-4	A61M25/00		
X	EP-A-0 154 403 (MALLINCKRODT, INC.) * abstract; figures * ---	1-3			
X	EP-A-0 129 634 (DRETTNER) * claims; figures * ---	1-3			
X	US-A-3 938 501 (ERIKSON) * abstract; figures * ---	1			
A	EP-A-0 453 008 (CORDIS EUROPA N.V.) * column 2, last paragraph - column 3, paragraph 1; figures * -----	4			
TECHNICAL FIELDS SEARCHED (Int.Cl.5)					
A61M					
The present search report has been drawn up for all claims					
Place of search	Date of completion of the search	Examiner			
THE HAGUE	21 April 1994	Mir y Guillén, V			
CATEGORY OF CITED DOCUMENTS					
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document					
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